954,976

PATENT SPECIFICATION

DRAWINGS ATTACHED

954,976

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Date of filing Complete Specification: Oct. 3, 1960.

Application Date: Oct. 10, 1959. No. 34410/59.

Complete Specification Published: April 8, 1964.

Index at acceptance:—G3 R(2A1, 31C1, 69); B6 B(8G, 8H)

International Classification:—G 05 d (B 65 h)

COMPLETE SPECIFICATION

Correction Device for Travelling Continuous Material

We, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London, N.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a correction device for travelling continuous material and is concerned with the location and tracking of such material whilst it is running, for example, through a processing machine or to a packing device such as a take-off roller.

Correction devices of this kind are usually included in control devices for maintaining lengths of sheet material along a predetermined path, comprising a detector device to be influenced by the material so as to operate the correction device for restoring the material to its desired path if it tends to stray.

An example of such a control device, for use with sheet material, is disclosed in our pending patent application No. 4999/58 (Serial No. 909,569), and includes a common form of correcting device comprising a pair of rollers riding on the surface of the material and arranged in chevron disposition across its width. By tilting the chevron towards one side or other the material can be caused to move towards that side. This form of correcting device provides different correcting forces from each roller, depending upon their angles to the path of the material and can result in uneven tensions being set up in the material after it has passed through the control device.

According to the present invention a correcting device for restoring travelling continuous material to its desired path if it tends to stray comprises a roller or rollers rotatably mounted around a rotatable support which extends axially through the or each roller, the axis of rotation of the roller or rollers being disposed at an acute angle to the axis of rotation of the support, and means for automatically rotating the support about its own axis in response to deviations of the material from the desired path.

With this arrangement, by rotation of the support about its axis of rotation, the roller can be tilted so that the direction of motion of its point of contact with travelling material can be varied between extreme directions disposed to right and left of the path of the material and at the said acute angle to it.

Preferably a plurality of similar rollers are mounted around said support in axially-spaced positions relative to the support, the axes of the rollers being parallel to one another.

The invention also includes a control device for maintaining a length of sheet material along a predetermined path comprising a correcting device as defined above. The control device preferably includes a detecting device arranged to actuate the correcting device as described in the specification of our pending Patent Application No. 4999/58 (Serial No. 909,569).

One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a diagrammatic perspective view of a control device for rubber tread strip, showing a partly cut-away tread strip;

Figure 2 is a front elevation, partly in cross-section, of the control device shown in Figure 1;

Figure 3 is a plan view of part of the control device shown in Figures 1 and 2;

Figure 4 is a diagrammatic plan view showing the correcting device set to give maximum correction in one direction;

Figure 5 is a diagrammatic plan view showing the correcting device set to give maximum correction in the opposite direction to that shown in Figure 4.

Figure 1 shows, briefly, a control device 1 for maintaining a length of sheet material along a predetermined path incorporating a

correcting device 2 in accordance with the invention mounted in a processing line for producing rubber tread strip for pneumatic tyres. A tread strip 3 is shown (partly cut-away) passing over the correcting device 2 from a driven conveyor roller 4 and then passing through a detecting device 5. The detecting device 5 serves to actuate the correcting device 2 to keep the moving tread strip 3 in a predetermined lateral position on the processing line, thus enabling other components such as sidewall strips to be applied accurately to the tread strip.

The correcting device 2 (see Figures 1, 2 and 3) comprises a shaft 6 rotatably supported in brackets 7 and 8 attached to a supporting framework 9 which is mounted in a fixed position relative to the conveyor roller 4. The shaft 6 is disposed at right-angles to the longitudinal direction of the conveyor, and is drivable via a flexible coupling 10 and reduction gear-box 11 by a reversible electric motor 12.

Mounted on the shaft 6 is a number of skew bushes 13, each having inner and outer cylindrical surfaces 14 and 15 respectively (see Figure 2). The inner cylindrical surface 14 of each bush 13 is formed by a bore passing through the bush, the axis of the bore making an angle A relative to the axis of the cylinder defined by the outer surface 15 of the bush. The inner cylindrical surface 14 is of diameter such as to be a tight fit on the shaft 6 and the outer cylindrical surface is of diameter such as to be a tight fit in the inner race 16 of a ball-bearing 17, the outer race of which forms a roller 18 for engaging the surface of the tread strip 3 as it passes above the shaft 6. In assembly of the device, a bearing is first fitted on each bush and the bushes with the bearings in position are then mounted on the shaft so that the axes of the bearings, that is, the axes of the outer surfaces 15 of the bushes, are all parallel. Grub screws, not illustrated, are provided in screw-threaded holes in the bushes 13 to engage a groove 19 in the shaft 6 (see Figure 1) and lock the bushes in position. Eleven bushes 13 and bearings 17 are mounted on the shaft 6 for engaging the tread strip 3 at spaced points across substantially its whole width.

The end of the shaft 6 remote from the motor 12 projects into a housing 20 and carries a cam 21, the cam 21 being fixed to the shaft. A pair of limit switches 22 (only one of which is shown in Figure 2) are mounted in the housing 20, one to be operated by the cam 21 when the shaft 6 is in the angular position corresponding to maximum tilt (viewed from above) of the rollers 18 in one direction, and the other to be operated by the cam 21 when the shaft 6 is in the angular position corresponding to maximum tilt of the rollers 18 in the opposite direction. The limit switches 22 are connected in circuit with the motor 12 to stop rotation of the motor whenever one or other of said angular positions is reached, further operation of the motor then being possible only in the reverse direction.

The detecting device 5 (see Figure 1) is described fully in the specification of our co-pending U.K. Patent Application No. 4999/58 (Serial No. 909,569). Briefly, it consists of two photo-electric cells 23, 24 and associated lamps 25, 26 respectively, the cells and lamps being mounted one pair on each of the brackets 27 and 28. The brackets 27 and 28 are each slidable transversely with respect to the path of the tread strip 3 on a fixed guide shaft 29. A lead screw 30 having oppositely screw-threaded portions 31 and 32 engaged with correspondingly screw-threaded holes in the brackets 27, 28 is provided to move the brackets 27, 28 simultaneously by equal distances towards or away from one another.

The lead screw 30 is drivable by an electric motor (not shown) controlled by relays in circuit with the photo-electric cells. The relays are operated by the two photo-electric cells in such a manner that when both cells "see" their lamps the screw 30 will be rotated to traverse the brackets 27, 28 towards one another until one lamp is obscured, when operation will cease and the correcting device 2 will be brought into operation in a manner to be described. If both lamps are obscured the rotation of the screw 30 will be reversed to cause the cells to be traversed outwardly. If the cells are influenced in opposite senses, i.e. if one "sees" its lamp whilst the other is obscured, the relays isolate the motor driving the screw 30 whilst the correcting device 2 operates to change the direction of the travelling tread strip 3 and thus to bring it into a position lying symmetrically between the cells 23, 24. A timing circuit (not shown) is incorporated to ensure that the control device does not over-correct the path of the tread strip at each operation of the device, thus avoiding the condition known as "hunting". The timing circuit is described in the specification of our co-pending U.K. Patent Application No. 499/58 (Serial No. 909,569).

The operation of the correcting device 2 is as follows.

The uppermost parts of the bearing rollers 18 engage the lower surface of the tread strip 3 as it passes above them, the tread strip contacting the rollers for a small part of their circumference. The rollers 18 are thus caused to revolve and roll under the weight of the travelling tread strip. By rotation of the shaft 6 the angular disposition of the rollers relative to the path of the tread strip can be varied between extreme positions at the acute angle A to the path. Figures 4 and 5 illustrate diagrammatically the disposition, viewed from above the correcting device, of the rollers 18 in their extreme angular dispositions to each side, respectively. The lateral edges of the tread strip 3 are shown by dotted lines in

Figures 4 and 5, and its direction of travel by the dotted arrows. The direction of movement of the uppermost parts of the rollers as they revolve may thus be varied between extreme directions at the acute angle A to the path and to the right or left of it according to the angular position of the shaft 6. When the rollers lie at an angle to the path, when viewed from above, they will impart a sideways thrust to the tread strip as it passes above them and can thus move it laterally to correct any displacement from its desired path. By rotation of the shaft 6, by the motor 12 controlled from the detecting device 5, the angle of the rollers, when viewed from above, can be varied so as to adjust the degree of lateral thrust applied and thus the degree of correction provided.

In the "zero" position of the rollers 18 (see Figures 2 and 3), in which their uppermost points move in the direction of the path of the tread strip 3, it will be understood that their planes will be inclined to the vertical and that one edge of their outer surfaces will thus engage and roll in contact with the surface of the tread. As the shaft 6 is rotated to increase the degree of correction in either direction the rollers will become more upright as their angle to the path, when viewed from above, increases until at their maximum correction positions they will be upright so that they engage the tread strip with the full width of their outer faces. Thus, not only does the angle between the path and the direction of movement of the point of contact of each roller increase, but also the area of contact of each roller increases, this also helping to increase the lateral thrust applied to the tread strip.

It will be understood that rotation of the shaft through 180 degrees is sufficient to move the rollers 18 from one maximum correction position to the other. Since the rollers are spaced across the whole width of the tread strip the lateral thrust is applied substantially uniformly across it so that no risk of any unequal tensions or distortion of the strip occurs. Furthermore, since the axis of the shaft 6 itself is fixed, considerably less space is required for this correction device than for the previously mentioned known chevron roller type of correction device. Great sensitivity of control is obtained by using the reduction gear 11 in the drive of the shaft so as to increase the amount of rotation of the electric motor 12 required to move the rollers 18 between their extreme positions.

For use with some materials, particularly materials having a hard surface, it may be desirable for the area of contact of each roller with the material to be substantially constant in all its positions. For this purpose the outer surfaces of the rollers may take the form of parallel-sided truncated spheres. They may be provided with a degree of resilience for increasing their effectiveness with such hard-surfaced materials, for example, by fitting to them tyres of rubber or other resilient material.

WHAT WE CLAIM IS:—

1. A correcting device for restoring travelling continuous material to its desired path if it tends to stray comprising a roller or rollers rotatably mounted around a rotatable support which extends axially through the or each roller, the axis of rotation of the roller or rollers being disposed at an acute angle to the axis of rotation of the support, and means for automatically rotating the support about its own axis in response to deviations of the material from the desired path.

2. A correcting device according to claim 1 having a plurality of similar rollers mounted around said support in axially-spaced positions relative to the support, the axis of the rollers being parallel to one another.

3. A correcting device according to either of the preceding claims wherein the roller or rollers is or are cylindrical in form.

4. A correcting device according to either claim 1 or claim 2 wherein the roller or rollers take the form of a parallel-sided truncated sphere or spheres.

5. A correcting device according to any of the preceding claims wherein the outer surface or surfaces of the roller or rollers is or are of resilient material.

6. A correcting device according to any of the preceding claims wherein the roller or rollers is or are rotatably mounted on ball-bearings.

7. A control device for maintaining a length of sheet material along a predetermined path comprising a correcting device according to any of the preceding claims and a detecting device to detect deviations of said material from a predetermined path and connected to actuate the correcting device to cause said correcting device to correct said deviations.

8. A control device for maintaining a length of sheet material along a predetermined path constructed and arranged substantially as described herein and shown in the accompanying drawings.

C. H. BOWYER,
Agent for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press (Leamington) Ltd.—1964. Published by The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

Fig. 1

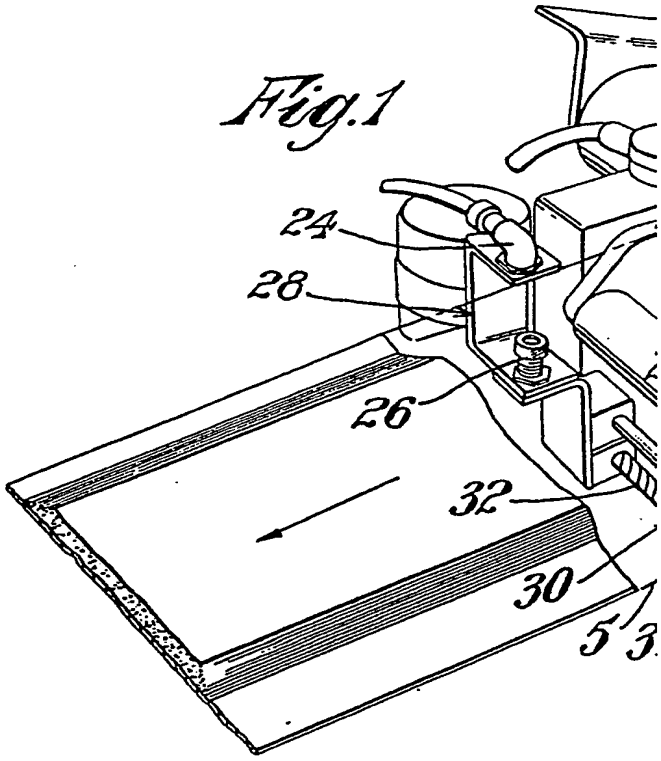
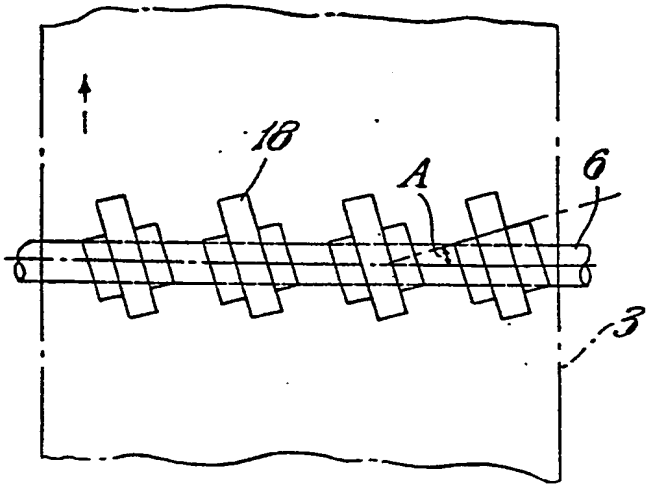


Fig. 4



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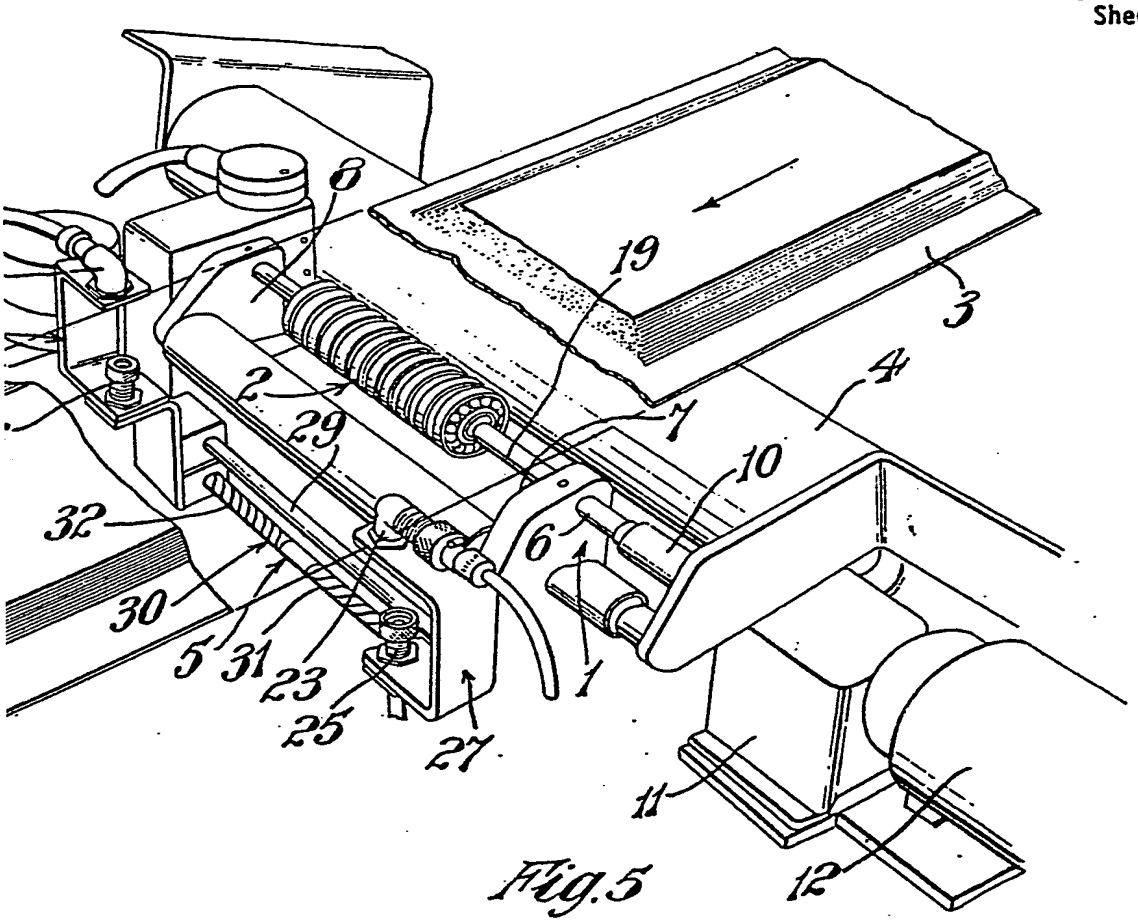

Fig.5

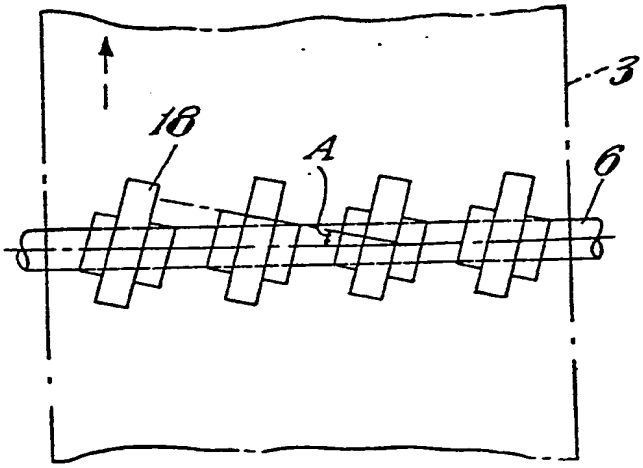

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Fig.1

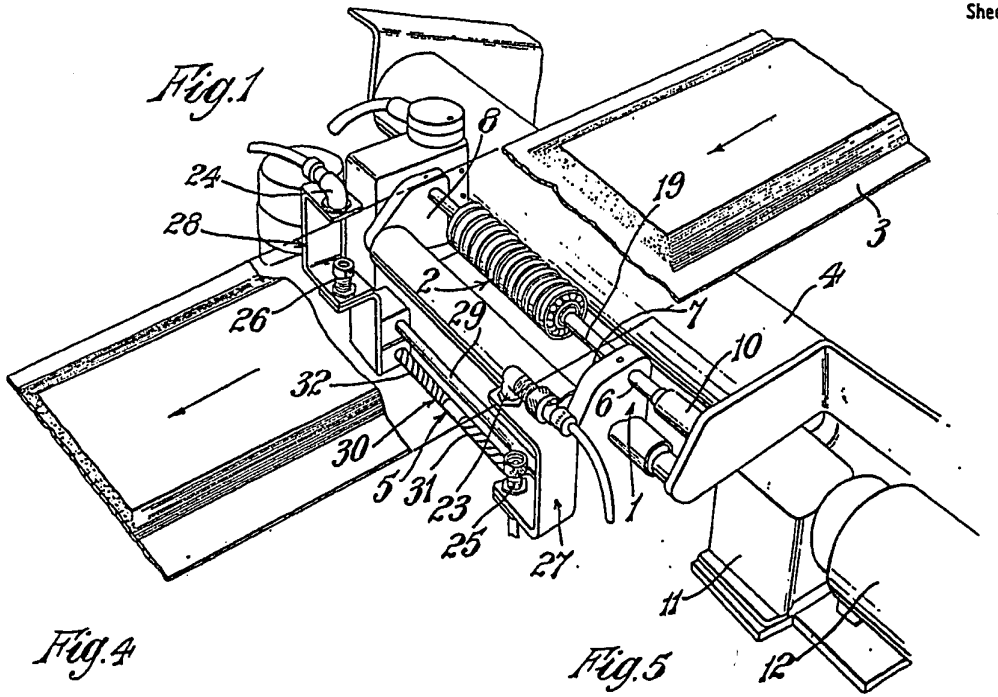


Fig.4

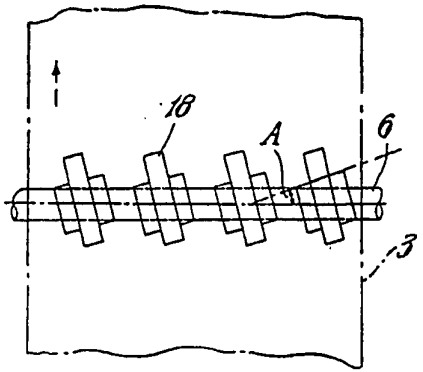
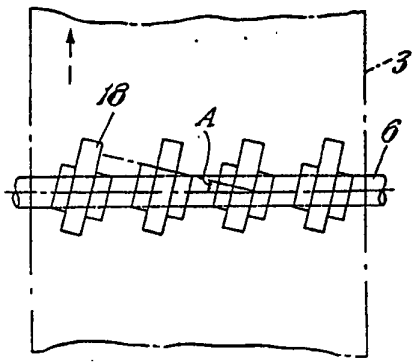
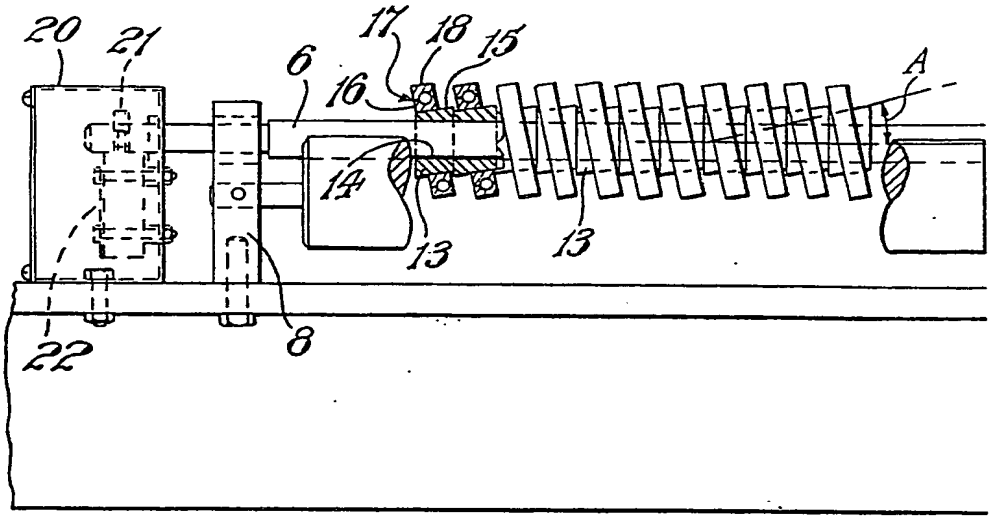


Fig.5

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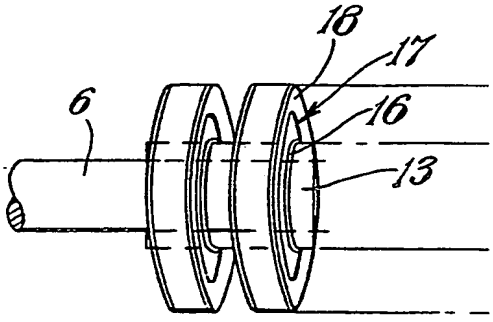
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Sheet 2

Fig. 2

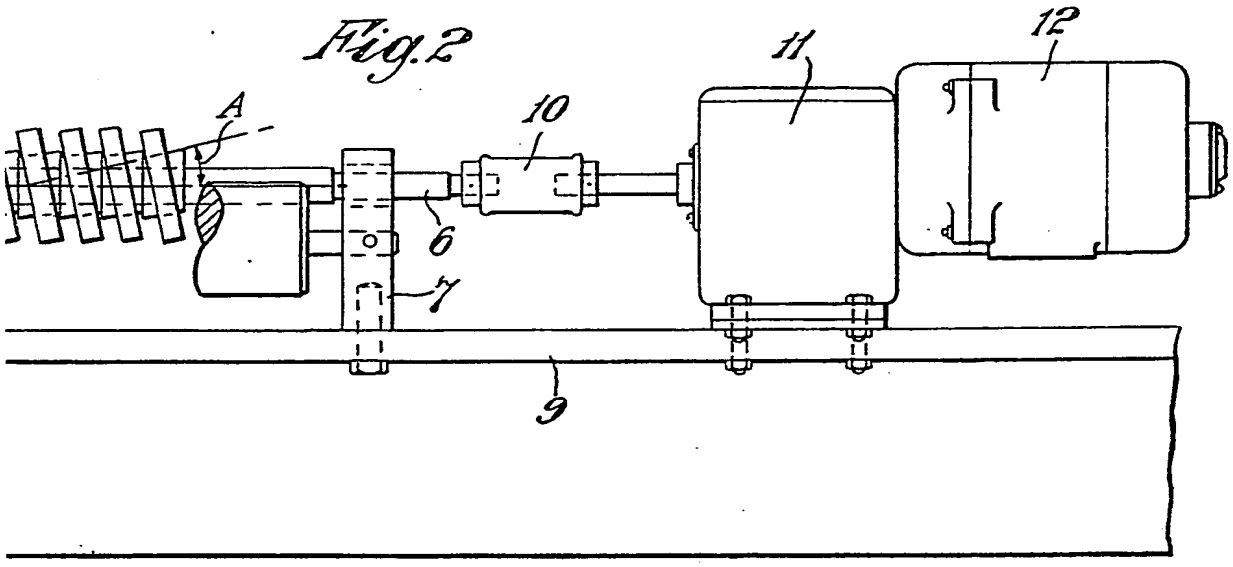

Fig. 3

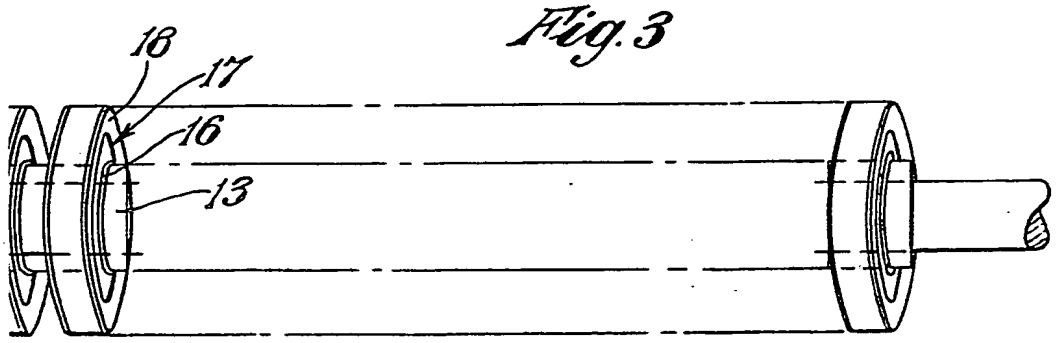

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Fig. 2

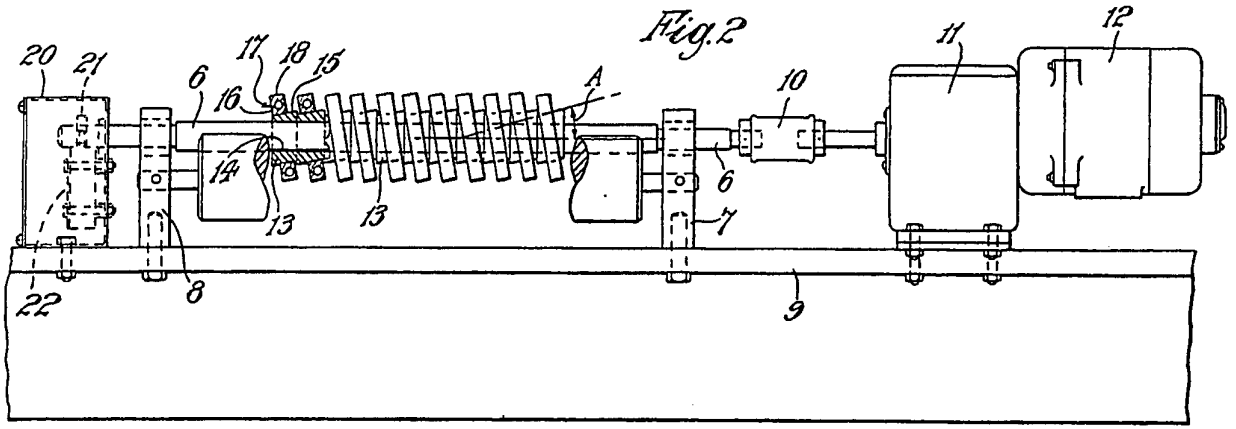

Fig. 3